ECE 251 Course Syllabus: Spring 2024
Introduction to Microcontrollers and IoT

Instructor: Steve Undy
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Office Hours: W 2:15-3:15 PM, Th 3:30-4:30 PM

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Class Lectures: Tuesdays and Thursdays 12:20 – 1:45 AM   Engr 120
Lab – L01: Mondays 5:30 – 8:20 PM   Engr C107
Lab – L02: Wednesdays 5:30 – 8:20 PM   Engr C107
Lab – L03: Fridays 11 AM – 1:50 PM   Engr C107
Final Exam: Wednesday May 8, 9:40 – 11:40 AM   Engr 120

Required Text: <u>Embedded Systems with ARM Cortex-M3 Microcontrollers in Assembly Language and C</u>, Dr. Yifeng Zhu, Third Edition preferred; all editions are acceptable.

Course Description: Microprocessor organization, assembly language, C language, I/O techniques, real-time interfaces, applications, hardware and software.

Prerequisites: ECE102 (Digital Circuit Logic)

Grading:
The following is the grading breakdown for each major component:
- Midterm Exam   20%
- Final Exam   25%
- Labs & Practical   35% (20% Practical, 80% Labs)
- Homework Assignments   10%
- Online Quizzes   10%
- Participation   5%

Grading Scale:
While lower cutoffs may be used, the following grade cut-offs are guaranteed:

A	A-	B+	B	B-	C+	C	D
93	90	87	83	80	77	70	60

Homework: Homework problems will usually be assigned every other week on Canvas. Late homework can be turned in up 7 days later or until it is reviewed in class, whichever is earlier, and will be subject to a 5%/day score reduction unless arrangements are made <u>before</u> the homework is due.

Quizzes: Quizzes will usually be given weekly on Canvas. They are used to help reinforce knowledge gained during lectures. They will be due at midnight on Friday with no exceptions.

Labs: There will be a series of 8 to 9 labs. They will vary from one to two weeks long each. There will be one lab practical exam during the course that will be held during your respective lab period. This practical will focus on your programming skills. Lab reports are due on Canvas on the Monday two weeks *after* they are completed. Late submissions can be turned in up to 21 days late (unless the final deadline near the end of the semester supersedes this) with a penalty of 25% the first week (i.e. between 0-6 days late), 50% the second week and 75% the third week. After 21 days late, the submission will receive a 0. For example, the maximum score for two days late is 75% while the maximum score for 10 days late is 50% and for > 21 days late is 0%.

Many students struggle with assembly language programming. The labs are the best way to learn this material. It is critically important to complete all labs. Failure to do so will strongly impact your overall grade. **Please come talk to me or the TAs before you get behind**.

Collaboration: You are expected to work on all homework problems and labs yourself, but *reasonable* collaboration is allowed and encouraged. **Copying homework or software from another student is not allowed and, at a minimum, will result in a 0 score**. No collaboration is allowed on any quiz, exam or practical.

Attendance in class is expected. If you are unable to attend class, it is your responsibility to obtain class notes or other information. I will use iClicker Cloud in class.

Academic Integrity:
This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.conflictresolution.colostate.edu/academic-integrity) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

All submitted work should be your own. Copying of language, structure, images, ideas, or thoughts of another, and representing them as one's own without proper acknowledgement (from web sites, books, papers, other students, solutions from previous offerings of this course, etc.) and failure to cite sources properly is not acceptable. Sources must always be appropriately referenced, whether the source is printed, electronic, or spoken. **My policy is that of zero tolerance**. Minor first infraction in HWs can lead to a zero score and/or up to to one letter level (e.g. A to B) reduction in the course grade. Major repeated infractions in HWs will result in "F" grade for the course as well as reporting to the Dean's Office.

ECE 251 Course Outline

- **Microprocessor Overview**
  - Representation of Integers
  - Memory
  - Major Components of a Microcontroller
  - ARM Cortex Microcontroller
- **C Programming Language**
  - Variables and Operators
  - Functions
  - Pointers, Arrays and Strings
  - Structures and Typedef
  - Recursion
- **ARM Cortex Assembly Language Programming**
  - ARM Cortex Instruction Set:
  - Register Model & Addressing Modes
  - Data transfer and manipulation instructions
  - Arithmetic Instructions
  - Logical and Bit Operations
  - Branch Instructions
- **Advanced Assembly Programming**
  - Loops
  - Stack and Stack Pointer
  - Subroutines and Parameter Passing
  - Fixed-Point and Floating-Point Numbers
- **ARM I/O**
  - Parallel I/O
  - Exceptions: Resets and Interrupts
  - SysTick Real Time Clock
  - ARM Cortex Serial I/O (SSI, I2C, UART)
  - Analog to Digital Converter
  - Pulse-width Modulation
- **Other Microcontroller Architectures**
- **FINAL EXAM** Wednesday, May 8, 2024, 9:40 – 11:40 AM Engr 120

Important information for students:

Masks are no longer required inside university buildings. You must, however, meet university vaccine or exemption requirements.

All students are expected and required to report to the COVID Reporter (https://covid.colostate.edu/reporter/) **when:**
- You suspect you have symptoms of COVID, regardless of whether or not you are vaccinated and even if your symptoms are mild
- You have tested positive for COVID through a non-CSU testing site, such as home test or test at a pharmacy
- You believe you may have been exposed to COVID go to the COVID Reporter and follow the guidance under "I believe I have been in close contact with someone who has COVID-19." This guidance will depend upon your individual circumstances

You will not be penalized in any way for reporting symptoms or concerns.

Do not ask me as your instructor to report for you. It is your responsibility to report through the COVID Reporter promptly.

As your instructor I may not ask you about vaccination status or if you have COVID but you may freely volunteer to send me information from a public health official - if you have been asked to isolate or quarantine.

When you complete the COVID Reporter, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600.

For the latest information about the University's COVID resources and information, including FAQs about the spring semester, please visit the **CSU COVID-19 site** https://covid.colostate.edu/.

CSU Has Resources to Help
Many of us are struggling. CSU is a community that cares. You are not alone. CSU Health Network Counseling Services has trained professionals who can help. Your student fees provide access to a wide range of support services. Call Counseling Services at (970) 491-6053, and they will work together with you to find out which services are right for you. Visit https://health.colostate.edu/about-counseling-services to learn more and https://health.colostate.edu/mental-health-resources/ for additional student mental health and well-being resources. If you are concerned about a friend or peer, use Tell Someone by calling (970) 491-1350 or visiting https://supportandsafety.colostate.edu/tell-someone/ to share your concerns with a professional who can discreetly connect the distressed individual with the proper resources. Rams Take Care of Rams. Reach out and ask for help if you or someone you know if having a difficult time.